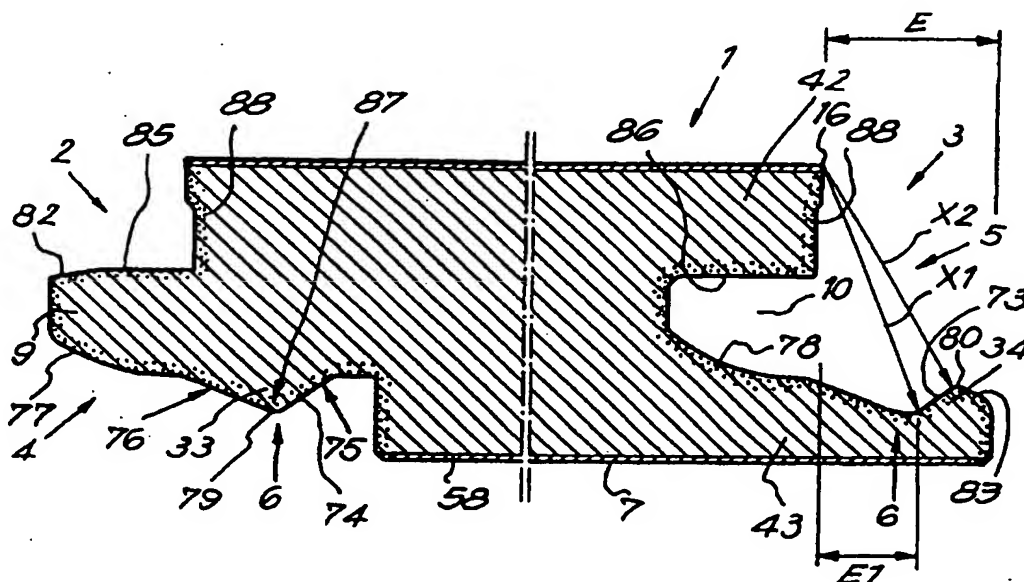




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(54) Title: FLOOR COVERING, CONSISTING OF HARD FLOOR PANELS AND METHOD FOR MANUFACTURING SUCH FLOOR PANELS



## (57) Abstract

Floor covering, consisting of hard floor panels (1) which, at least at the edges of two opposite sides (2-3, 26-27), are provided with coupling parts (4-5, 28-29), cooperating with each other, substantially in the form of a tongue (9-31) and a groove (10-32), characterized in that the coupling parts (4-5, 28-29) are provided with integrated mechanical locking means (6) which prevent the drifting apart of two coupled floor panels into a direction (R) perpendicular to the related edges (2-3, 26-27) and parallel to the underside (7) of the coupled floor panels (1).

Floor covering, consisting of hard floor panels and method for manufacturing such floor panels.

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5 This invention relates to a floor covering, consisting of hard floor panels, as well as to a method for manufacturing such floor panels.

10 In first instance, the invention is intended for so-called laminated floors, but generally it can also be applied for other kinds of floor covering, consisting of hard floor panels, such as veneer parquet, prefabricated parquet, or other floor panels which can be compared to laminated floor.

15

It is known that such floor panels can be applied in various ways.

20 According to a first possibility, the floor panels are attached at the underlying floor, either by glueing or by nailing them on. This technique has as a disadvantage that it is rather complicated and that subsequent changes can only be made by breaking out the floor panels.

25 According to a second possibility, the floor panels are installed loosely onto the underground, whereby the floor panels mutually match into each other by means of a tongue and groove coupling, whereby mostly they are glued together in the tongue and groove, too. The floor  
30 obtained in this manner, also called a floating parquet flooring, has as an advantage that it is easy to install and that the complete floor surface can move which often is convenient in order to receive possible expansion and shrinkage phenomena.

35

A disadvantage with a floor covering of the above-

for connecting floor panels.

The invention aims at an improved floor covering of the  
aforementioned type, the floor panels of which can be  
5 coupled to each other in an optimum manner and/or the  
floor panels of which can be manufactured in a smooth  
manner, and whereby preferably one or more of the  
aforementioned disadvantages are excluded.

10 The invention also aims at a floor covering which shows  
the advantage that no mistakes during installing, such as  
gaps and such, can be created.

Furthermore, the invention also aims at a floor covering  
15 whereby the subsequent development of gaps is excluded or  
at least counteracted in an optimum manner, whereby also  
the possibility of the penetration of dirt and humidity  
is minimized.

20 To this aim, the invention relates to a floor covering,  
consisting of hard floor panels which, at least at the  
edges of two opposite sides, are provided with coupling  
parts, cooperating with each other, substantially in the  
form of a tongue and a groove, characterized in that the  
25 coupling parts are provided with integrated mechanical  
locking means which prevent the drifting apart of two  
coupled floor panels into a direction perpendicular to  
the related edges and parallel to the underside of the  
coupled floor panels. Hereby, these coupling parts are  
30 optimized in such a manner that they allow that any  
form of play is counteracted and preferably is excluded.

By integrated mechanical locking means is understood that  
these form a fixed part of the floor panels, either by  
35 being connected in a fixed manner to the floor panels, or  
by being formed in one piece herewith.

binding agent or by means of melting together, is composed to a single compound, and/or of a product on the basis of synthetic material and/or of a chip board with fine chips.

5

Due to the fact that the coupling parts provide for an interlocking free from play, as well as due to the fact that these coupling parts are manufactured in one piece, from the basic material of the floor panels, a perfect connection between adjacent floor panels can always be guaranteed, even with repeated expansion and shrinkage of the floor surface.

This combination of characteristics can be combined or not with the aforementioned characteristic which states that the locking means exert a tension force upon each other.

According to a third important preferred form of embodiment, the characteristics of which may or may not be combined with the characteristics of the embodiments described above, the floor covering is characterized in that the lower lip which limits the lower side of the groove, extends beyond the upper lip; that the locking means are formed at least of a portion which inwardly slopes downward; and that this portion, at least partially, is located in the portion of the lower lip which extends beyond the upper lip. The advantages of these features will appear from the further description.

30

According to a preferred form of embodiment, the floor panels consist of elongated panels and the coupling parts described above are applied along the longitudinal sides of these panels.

35

According to a particular form of embodiment, coupling

receive expansion and shrinkage forces in an elastic manner, whereby it is avoided that the floor panels come unlocked or are damaged in an irreparable manner.

- 5 In the case that for the core use is made of a material based on synthetic material, to this end solid synthetic material can be used as well as a mixture of synthetic materials, eventually composed of recycled materials.
- 10 The floor covering preferably is formed by joining the floor panels into each other free of glue. Hereby, the connections are of such nature that the floor panels can be disassembled without being damaged, such that, for example, when moving, they can be taken along in order to
- 15 be placed again. It is, however, clear that a glueing between tongue and groove is not excluded.

The invention, of course, also relates to floor panels which allow the realization of the aforementioned floor

20 covering.

- The invention also relates to a method for the manufacturing of the aforementioned floor panels which shows the advantage that the tongues and/or grooves,
- 25 including the corresponding locking means, can be provided at the floor panels at high production speeds without problems. More particularly, it aims at a method which allows that the rather complicated forms of the tongue and the groove of the aforementioned floor panels
- 30 can be realized completely by means of milling cutters, the diameter of which can be chosen independently of the form to be realized, such that the use of small milling cutters, for example finger cutters, with diameters smaller than the depth of the tongue or groove can be
- 35 excluded.

coupling parts according to figure 2 match into each other;

figure 5, on a larger scale, represents a cross-section according to line V-V in figure 1;

5 figures 6 and 7 represent how two floor panels with coupling parts according to figure 5 match into each other;

10 figures 8 to 11 represent a number of variants of coupling parts of floor panels according to the invention;

figure 12 schematically represents how the floor parts can be provided with coupling parts;

figure 13 represents a cross-section according to line XIII-XIII in figure 12;

15 figures 14 to 21, on a larger scale and in cross-section, represent the penetration of the milling cutters which are indicated in figure 12 with arrows F14 to F21;

20 figure 22 represents a floor panel according to the invention;

figure 23, on a larger scale, represents the coupling of two floor panels of figure 22;

figures 24 and 25 represent two manners of coupling floor panels according to figure 22 to each other.

25

The invention relates to a floor covering which is composed of hard floor panels 1, for example, such as shown in figure 1.

30 These floor panels 1 can be of various shape, for example, rectangular or square, or of any other shape.

In the most preferred form of embodiment, they shall be manufactured in an elongated form, such as shown in  
35 figure 1, for example, with a length of 1 to 2 meters. The thickness, however, can also vary, but is preferably

occurrence of any snap-together effect.

5 In the represented example, the locking means 9 consist of a first locking element 11, formed by a protrusion with a bent round shape at the lower side 12 of the tongue 9, and a second locking element 13, formed by a recess with a bent hollow shape in the lower wall 14 of the groove 10.

10 The locking elements 11-13 provide for that two floor panels 1 which are coupled to each other can not perform a lateral movement in the horizontal plane in respect to each other.

15 In order to obtain that two floor panels 1 can be inserted into each other by means of a turning movement, the curvatures preferably are circle-shaped. The bottom side 12 has a curvature with a radius  $R_1$ , the center of which coincides with the related upper edge 15 of the floor panel 1, whereas the lower wall 14 shows a curvature with a radius  $R_2$  which is equal to the radius  $R_1$ , but whereby its center coincides with the related upper edge 16. Radii  $R_1$  and  $R_2$  may also be applied which are larger or smaller than the distance to the upper edge 15, 16 respectively, and/or which differ from each other in size.

25 The upper side 17 of the tongue 9 and the upper wall 18 of the groove 10 are preferably flat and preferably are situated in the horizontal plane.

30 The front sides 19 and 20 of the tongue 9 and the groove 10 of two interlocked floor panels 1 preferably do not fit closely against each other, such, that in between an intermediate space 21 is created into which possible dust remainders or such can be pushed away by means of the

elements 33 and 34 which grip behind each other.

As represented in figures 5 to 7, the locking element 33 preferably consists of a protrusion of the lower side 35 of the tongue 31 which can take place in a recess 36 in the lower wall 37 of the groove 32. The locking element 34 is formed by the upward directed part which limits the recess 36.

In this case, the locking elements 33-34 have contact planes 38-39 which are parallel to each other and preferably extend in an inclined manner, according to a direction which simplifies the snapping-together. The tangent line L which is determined by the contact planes 38-39, hereby forms an angle A with the underside 7 which is smaller than  $90^\circ$ .

The locking elements 33-34 preferably are provided with inclined portions 40 and 41 which, when engaging two floor panels 1, cooperate with each other in such a manner that the locking elements 33-34 can easily be pushed over each other until they grip behind each other by means of a snap-together effect.

The thickness W1 of the tongue 31 preferably is equal to the width W of the groove 32, such that the upper lip 42, when exerting a pressure P, is supported by the tongue 31 which, in its turn, then is supported by the lower lip 43.

Analogous to the chamfer 24 and recess 25, a recess 44 and a chamfer 45 are provided also at the edges 28-29.

It is noted that such a snap-together coupling can also be applied at the edges 2-3. Hereby, this can be a snap-together coupling analogous to these of figures 5 to 7,



allows that the coupling parts 4-5 can be brought into each other easily. The intermediate space S forms a chamber which offers space for dust and similar which, when engaging two floor panels 1, gets there eventually.

5

In the case of a snap-together connection, for example, a connection, such as represented in figures 7 to 9, preferably always the tongue 9-31 has a shape, thickening towards below, which can cooperate with a widened portion in the groove 10.

10

In figure 10, a variant is represented whereby at least at the height of the upper edges 15-16, a sealing material 52 is provided, as a result of which a watertight sealing can be guaranteed. This sealing material 52 may consist of a strip or covering which is provided previously at the floor panel 1, either at one or both upper edges 15-16.

15

In figure 11, a further variant is represented, whereby the locking means 6 are formed by an upward directed portion 53 at the tongue 9 which, as a result of a turning movement, is brought behind a downward-directed portion 54 at the upper wall 18. More particularly, this is obtained by realizing the upper side 17 and the upper wall 18 with a curvature R3, the center of which is situated at the edges 15-16, and realizing the lower side 12 and the lower wall 14 with a radius R4, the center of which is also situated at the upper edges 15 and 16, respectively. These radii R3-R4 can be chosen otherwise, too.

20

25

30

In general, according to the invention, the difference between, on one hand, the radius R1, R3 respectively, and, on the other hand, the radius R2, R4 respectively, preferably should not be larger than 2 mm.

35

advantage that the lower lip must not be strengthened by a reinforcement strip or the like.

5 According to a particular form of embodiment, the central line M1 through the tongue 9 and the groove 10 is situated lower than the center M2 of the floor panel 1, such, that the upper lip 22-42 is thicker than the lower lip 23-43. In first instance, this is essential in this kind of connections, because then it is the lower lip 23-10 43 which bends, such that the upper side of the floor panel 1 is kept free of possible deformations.

As explained in the introduction, for the core 8 a material is chosen from the following series:

- 15 -a ground product which, by means of a binding agent or by means of melting together, is composed to a single compound;  
-a product based on synthetic material;  
-chip board with fine chips.

20

The invention shows its usefulness, in first instance, preferably with laminated flooring, due to the reasons explained in the introduction.

25 As represented in the examples of the figures 2 to 11, such laminated flooring preferably consists of a core 8 made of MDF board, HDF board or similar, whereby at least at the upper side of this core 8 one or more layers of material are provided.

30

More particularly, it is preferred that the laminated flooring is provided with a decorative layer 55 and a protective top layer 56. The decorative layer 55 is a layer, impregnated with resin, for example, made of35 paper, which can be imprinted with a variety of patterns, such as a wood pattern, a pattern in the form of stone,

the related floor panel 1.

5 This is illustrated in figures 13, 14 and 15, wherein it is represented how a groove 10 is realized by means of two milling cycles by means of two milling cutters 63 and 64. Figures 16 and 17 represent how the tongue 9 is realized by means of milling cutters 65 and 66.

10 The figures 18-19 and 20-21 represent similar views showing how the groove 32 and the tongue 31 are realized by means of milling cutters 67-68 and 69-70, positioned at an angle.

15 During each of the aforementioned milling cycles, each time substantially the final shape of one flank is realized. For example, the milling cutter 63 of figure 14 determines the final shape of the lower flank 71 of the groove 10, whereas the milling cutter 64 determines the final shape of the upper flank 72.

20 As mentioned in the introduction, preferably milling cutters 63 to 72 shall be applied, having diameters  $G$  which are at least 5 times, and even better at least 20 times larger than the thickness  $F$  of the floor panels 1.

25 Apart of the mentioned milling cutters, preferably still other milling cutters are applied, for example, in order to remove a part of the material to be removed already during a first premachining cycle.

30 In the figures 22 to 25, a particularly preferred form of embodiment of a floor panel 1 according to the invention is represented. Hereby, the parts which are taken over from the aforegoing forms of embodiment are indicated  
35 with corresponding references.

and 70 degrees. In first instance in the case that use is made of the embodiment whereby a tension force  $K$  is realized, an angle  $A$  of 30 to 70 degrees is ideal in order, on one hand, to effect an optimum pressing-together of the floor panels 1 and, on the other hand, to  
5 obtain that the floor panels 1 can easily be engaged, respectively disassembled.

Although the pressing force  $K_1$  preferably is delivered by  
10 the aforementioned lip 43, the invention does not exclude other forms of embodiment whereby this force is delivered by other bendable portions.

It is noted that the bending  $V$  is relatively small, for  
15 example, several hundredths up to several tenths of a millimeter, and does not have an influence upon the placement of the floor covering. Furthermore is noted that such floor covering generally is placed upon an underlayer which is elastically compressible, as a result  
20 of which the bending  $V$  of the lip 43 exclusively results in the fact that the underlayer locally is compressed somewhat more.

Due to the fact that the lip 43 is bent apart and that it  
25 remains somewhat bent apart in engaged position, also the advantage is effected that, when exerting a pressure upon the floor covering, for example, when placing an object thereupon, the pressing-together force is enhanced and, thus, the development of gaps is counteracted even more.

30 It is noted that the inventor has found that, contrary to all expectations, an ideal tension force can be realized by manufacturing the coupling parts 4-5, including the locking elements 33-34, and preferably the complete core  
35 8, of HDF board or MDF board, although these materials only allow a minor elastic deformation.

It is noted that the shapes of the coupling parts 4-5 shown in figures 22 to 25 can also be used for the coupling parts 28-29 of the short sides.

5 According to the invention, in the case that the four sides 2-3-26-27 are provided with coupling parts 4-5-28-29, these coupling parts can be realized in such a manner that in one direction a firmer engagement than in the  
10 floor panels 1, for example, such as represented in figure 1, the locking at the small sides 26-27 preferably shall be more pronounced than at the longitudinal sides 2-3. The length of the coupling at the small sides, namely, is smaller and, in principle, less firm. This is  
15 compensated by providing in a more pronounced locking.

This difference in engagement can be obtained by realizing the contact surfaces 73-74 under different angles.

20 Preferably, the aforementioned protrusion, more particularly the locking element 33, is bordered by at least two portions 75-76, respectively a portion 75 with a strong inclination which provides for the locking, and  
25 a portion 76 with a weaker inclination which renders the engagement of the coupling parts easier. In the embodiment of figures 22 to 25, these portions 75-76 are formed by straight planes, but, as already described in reference to figure 9, use can also be made of curved  
30 portions 50-51. In figure 5, these are the contact surface 38 and the inclined portion 40.

In the preferred form of embodiment, the floor panels 1 according to the invention comprise coupling parts 4-5  
35 and/or 28-29 showing one of the following or the combination of two or more of the following features:

- location of the top side of the floor panels 1, with the advantage that the aforementioned tension force is optimally transferred to the upper side of the floor panels 1 and that the development of openings between the floor panels 1 is counteracted;
- 5 - contact surfaces 85-86, more particularly abutment surfaces, formed by the upper side of the tongue 9 and the upper side of the groove 10 which, over the largest portion of their length, run parallel to the plane which is defined by the floor panels 1, as well as contact surfaces cooperating with each other, formed by curvatures 77-78, with the advantage that no mutual displacement in height between two engaged floor panels 1 is possible, even if the insertion depth of the tongue 9 into the groove 10 should vary due to which causes whatsoever, in other words, that no height differences may occur between the adjacent floor panels.
- 10
- 15
- 20 In the form of embodiment of figures 22 to 25, all these characteristics are combined; it is, however, clear that, as becomes evident from figures 2 to 11, these features can also be present separately or in a limited combination.
- 25
- As becomes evident from figures 5 to 7 and 22 to 25, an important characteristic of the preferred form of embodiment of the invention consists in that the locking means 6, in other words, the portion providing for the snap-together and engagement effect, are situated in that portion of the lower lip 23-43 which extends beyond the upper lip 22-42, more particularly, that the lowermost point 87 of the locking part 33 is situated under the top layer of the floor panel 1. For clarity's sake, this top layer is indicated in the figures 22 to 25 only as a single layer.
- 30
- 35

impregnation agents, pore-sealing agents, lacquers, resins, oils, paraffines and similar.

5 In figure 22, such impregnation 88 is represented schematically. This treatment can be performed over the complete surface of the sides 2-3 and/or 26-27 or only over well-defined portions hereof, for example, exclusively the surfaces of the tongue 9 and the groove 10.

10 The treatment with a surface densifying agent offers, in combination with the snap-together effect, the advantage that in various aspects better coupling features are obtained. As a result of this, the coupling parts 4-5  
15 and/or 28-29 better keep their shape and strength, even if the floor panels 1 are engaged and disassembled repeatedly. Especially in the case that for the core 8 use is made of HDF, MDF or similiar, by means of this treatment such a better quality of surface condition is  
20 obtained, that no abrasion of material occurs during engaging, respectively during disassembling.

This treatment also offers the advantage that, at least in the case of a surface hardening, the aforementioned  
25 elastic tensioning effect is enhanced.

The present invention is in no way limited to the forms of embodiment described by way of example and represented in the figures, however, can such floor covering and the  
30 pertaining floor panels 1 be realized in various forms and dimensions without leaving the scope of the invention.

For example, the various characteristics which are  
35 described by means of the represented forms of embodiment, may be combined with each other or not.

Claims:  

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- 1.- Floor covering, consisting of hard floor panels (1) which, at least at the edges of two opposite sides (2-3, 26-27), are provided with coupling parts (4-5, 28-29), cooperating with each other, substantially in the form of a tongue (9-31) and a groove (10-32), characterized in that the coupling parts (4-5, 28-29) are provided with integrated mechanical locking means (6) which prevent the drifting apart of two coupled floor panels into a direction (R) perpendicular to the related edges (2-3, 26-27) and parallel to the underside (7) of the coupled floor panels (1).
- 2.- Floor covering according to claim 1, characterized in that the coupling parts (4-5, 28-29) are provided with means, which are formed more particularly by the aforementioned locking means (6), which, in the engaged condition of two or more of such floor panels (1) exert a tension force upon each other which forces the floor panels (1) towards each other.
- 3.- Floor covering according to claim 2, characterized in that at least one of the coupling parts (5) has an elastically bendable portion which, in the engaged condition, is at least partially bent and in this manner provides the aforementioned tension force.
- 4.- Floor covering according to claim 3, characterized in that the elastically bendable portion consists of a lip, preferably the lip (43) limiting the lower side of the aforementioned groove (10).
- 5.- Floor covering according to claim 3 or 4, characterized in that the bendable portion is provided



8.- Floor covering according to any of the foregoing claims, characterized in that the basic material of the floor panels (1), in other words, the material of the core (8), consists of HDF board or MDF board, whereby the coupling parts (4-5-28-29) and the locking means (6) are formed out of this board.

9.- Floor covering according to any of the foregoing claims, characterized in that the floor panels (1) consist of elongated panels and that, at least at their longitudinal sides (2-3), they are provided with the aforementioned coupling parts (4-5).

10.- Floor covering according to any of the claims 1 to 8, characterized in that the floor panels (1) are rectangular or square and that, on all four sides (2-3-26-27), more particularly two by two, they are provided with the aforementioned coupling parts (4-5-28-29).

11.- Floor covering according to any of the foregoing claims, characterized in that the coupling parts (4-5 and/or 28-29) of at least two opposite sides (2-3, 26-27) are realized in such a manner that the floor panels (1) can be engaged by means of shifting them towards each other as well as by means of a turning movement, whereby, during the engagement by means of the turning movement, a bending occurs in the coupling parts (4-5 and/or 28-29), which bending is less pronounced, if not non-existent, in comparison to the bending which occurs when the floor panels (1) are engaged by means of shifting them towards each other.

12.- Floor covering according to any of the foregoing claims, characterized in that the locking means (6) substantially consist of a locking element (11-33-46) in the form of a protrusion, provided at the lower side (12)

in that the locking means (6), amongst others, are formed by locking elements (34) which are located in the portion of the lower lip (23-43) which extends beyond the upper lip (22-42), more particularly that the lowermost point  
5 (87) of engagement of the locking elements (34) is located underneath the top layer of the floor panel (1) which carries the related tongue (9).

18.- Floor covering according to claim 16 or 17,  
10 characterized in that the coupling parts (4-5) show one of the following or the combination of two or more of the following features:

- a curvature (77) at the lower side of the tongue (9) and/or a curvature (70) at the lip (43) which  
15 form a guidance when turning two floor panels (1) into each other;
- roundings (79-80) at the edges of the locking elements (33-34);
- dust chambers or similar (21-44-81) between all  
20 sides of the engaged floor panels (1) which are directed laterally towards each other;
- a shaping of the tongue (9) which is such that the upper side of the tongue (9) already with the first contact becomes situated under the lower side of the  
25 upper lip (42) when the floor panels (1) are shifted towards each other at the same level;
- a ramp surface (41-83), formed at the free extremity of the lower lip (43);
- in the engagement direction only one substantial  
30 contact point which is formed by a section (84) at the location of the top side of the floor panels (1);
- contact surfaces (85-86), more particularly abutment surfaces, formed by the upper side of the tongue (9) and the upper side of the groove (10) which, over  
35 the largest portion of their length, run parallel to the plane which is defined by the floor panels (1).

- 25.- Method for manufacturing of floor panels, as described in any of the previous claims, characterized in that the tongue (9-31) and/or groove (10-32) is realized by means of a milling process with at least two subsequent milling cycles by means of milling cutters (63-64-65-66-67-68-69-70) which are positioned in different angles in respect to the related floor panel (1).
- 26.- Method according to claim 25, characterized in that during each of the aforementioned milling cycles each time substantially the final shape of one flank (71-72), either of the tongue or of the groove, is realized.
- 27.- Method according to claim 25 or 26, characterized in that for the aforementioned two milling cycles milling cutters (63-64-65-66-67-68-69-70) are applied which extend outside the groove (10-32), respectively the tongue (9-31), and more particularly show diameters (G) which are at least 5 times larger than the thickness (F) of the floor panels (1), and preferably even at least 20 times larger than the thickness (F) of the floor panels (1).
- 28.- Method according to any of the claims 25 to 27, characterized in that at all four sides of the floor panel (1) a profile is provided and that the floor panels (1) are displaced according to two perpendicular movements (V1-V2), whereby during one of the movements profiles at two opposite edges are provided, whereas during the other movement profiles are provided at the small edges.

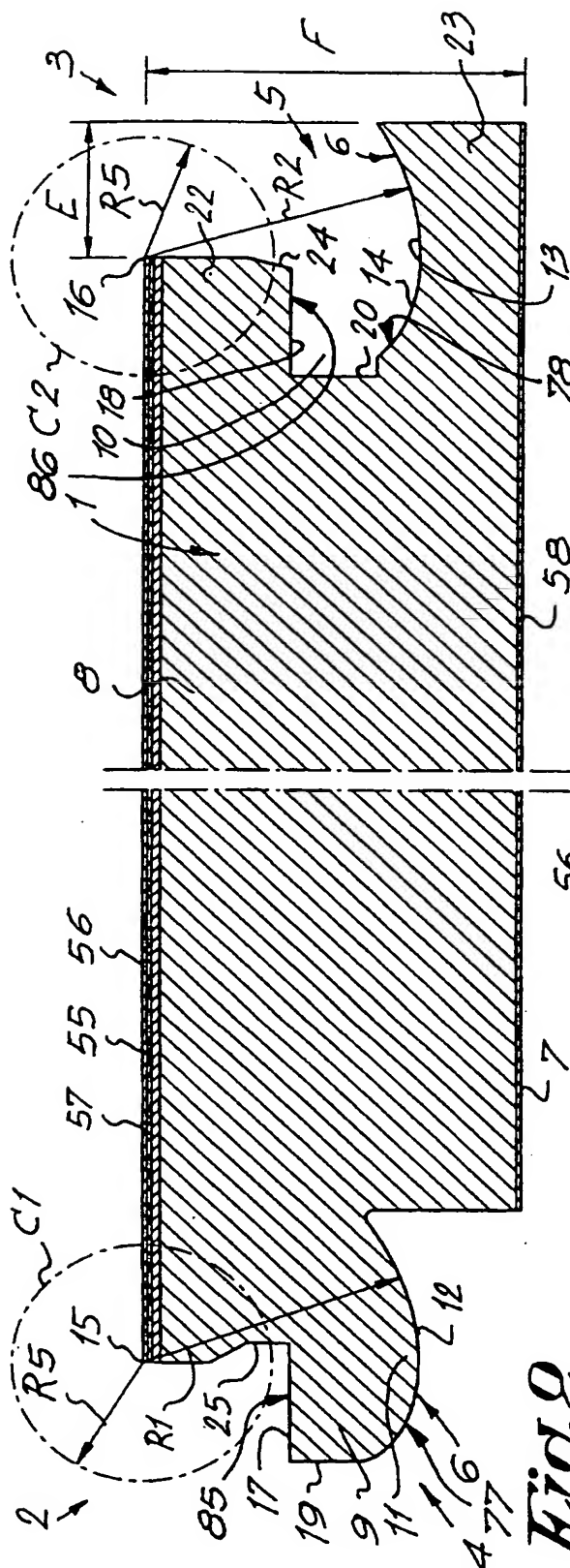


Fig. 9

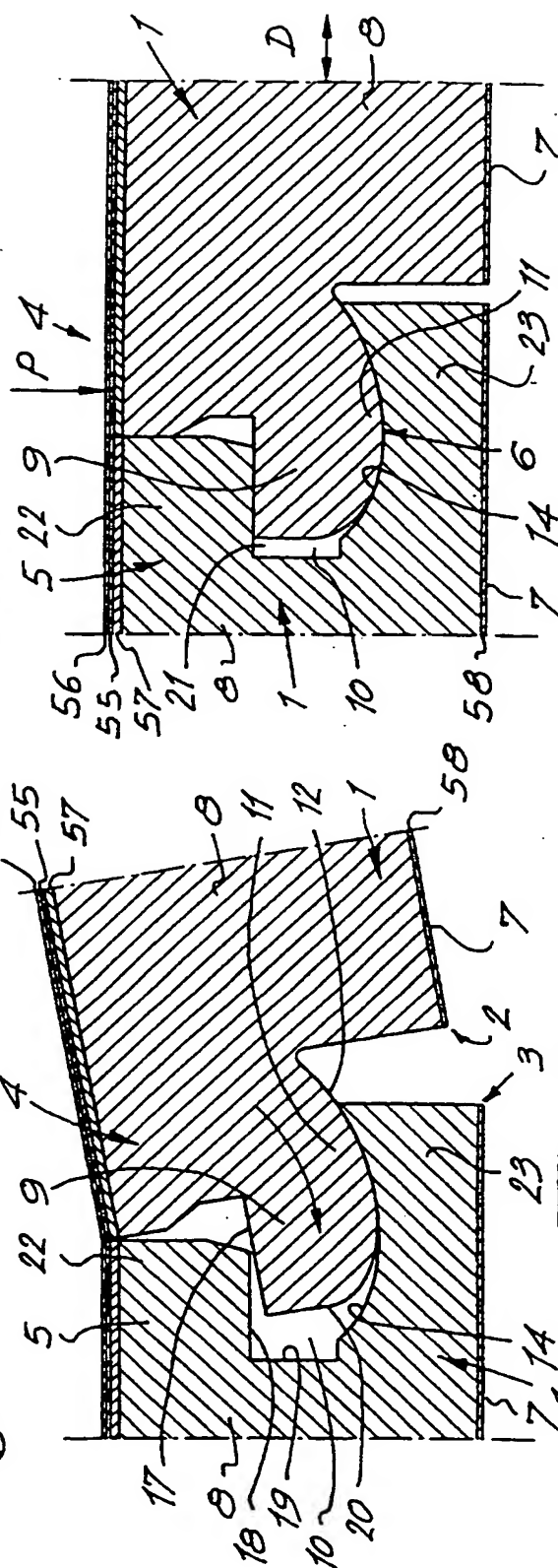


Fig. 3

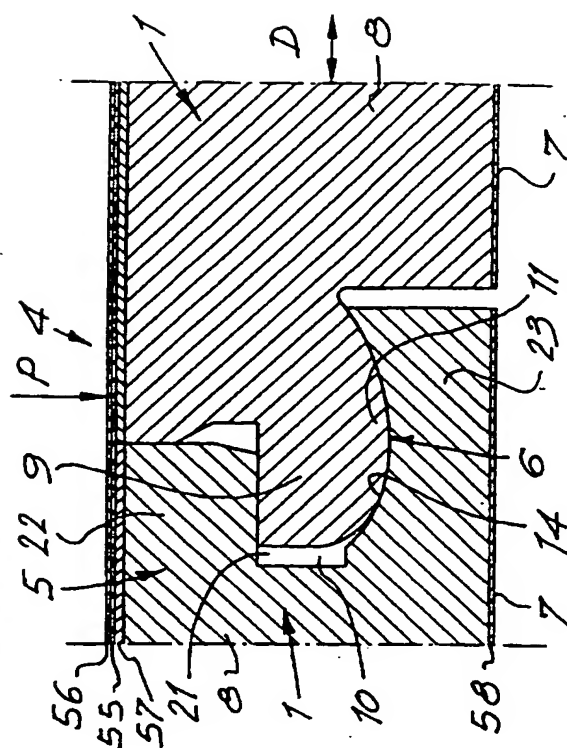
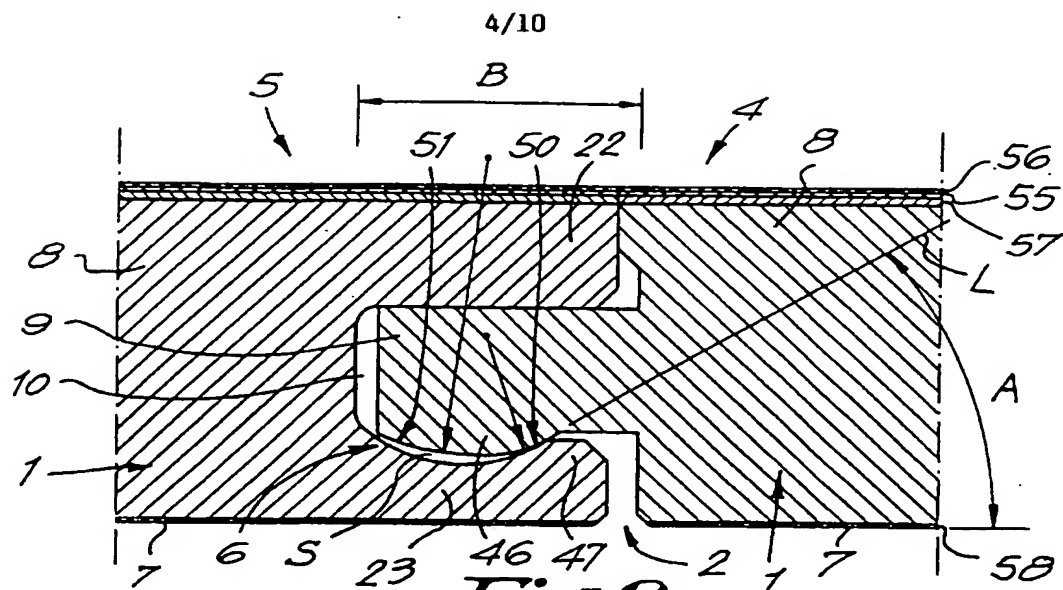
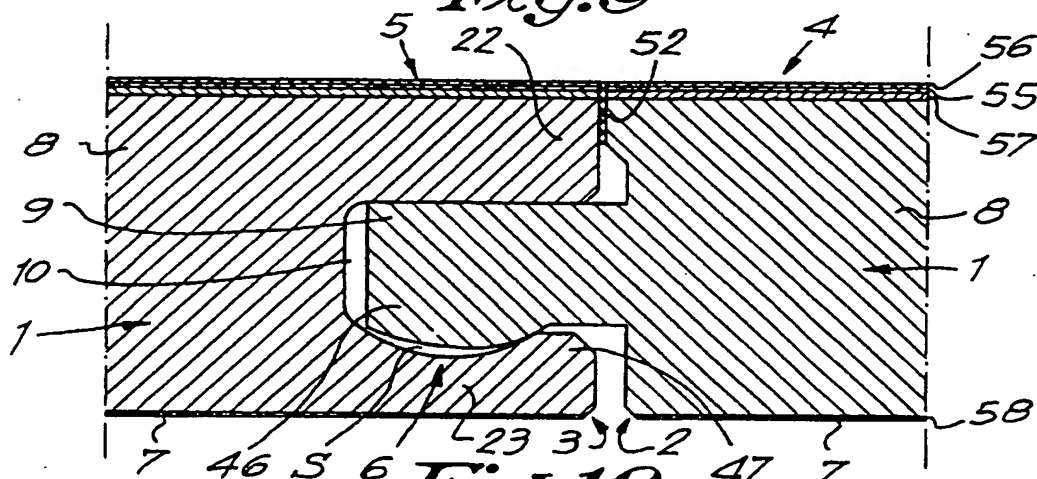


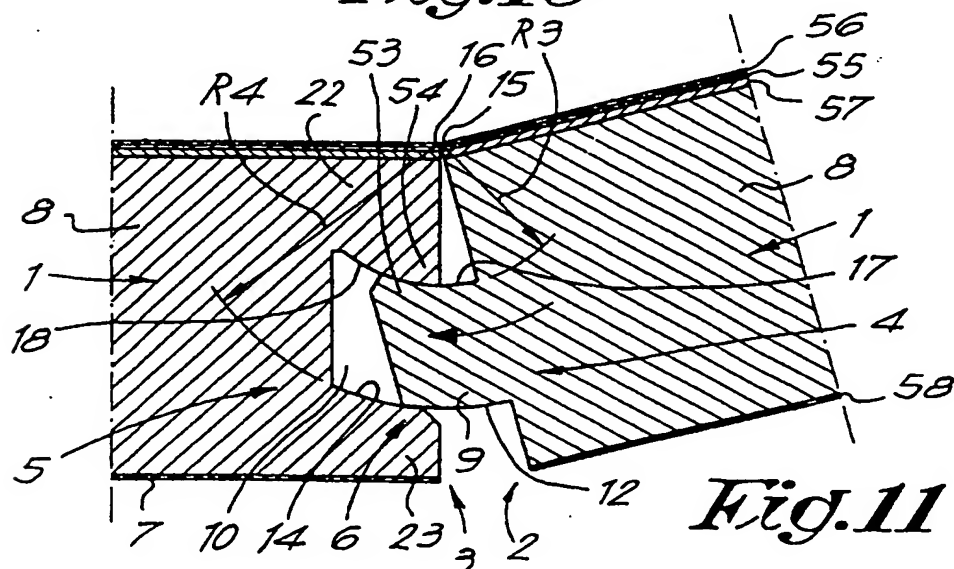
Fig. 4



**Fig. 9**

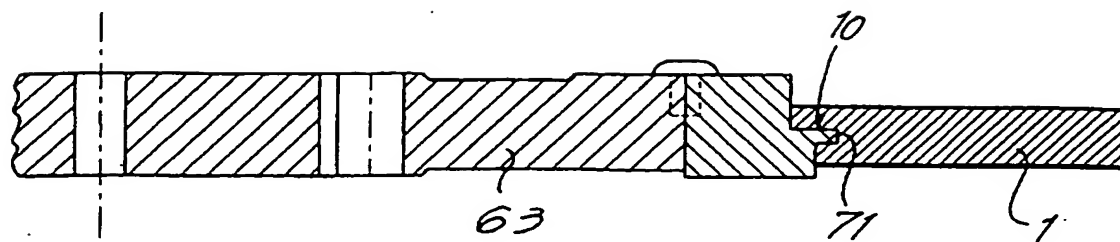


**Fig. 10**

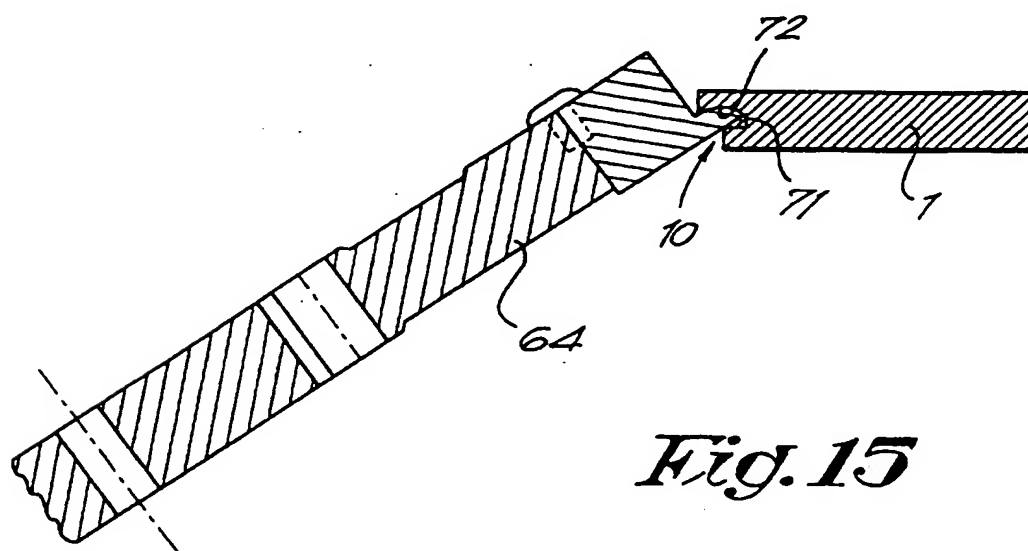


**Fig. 11**

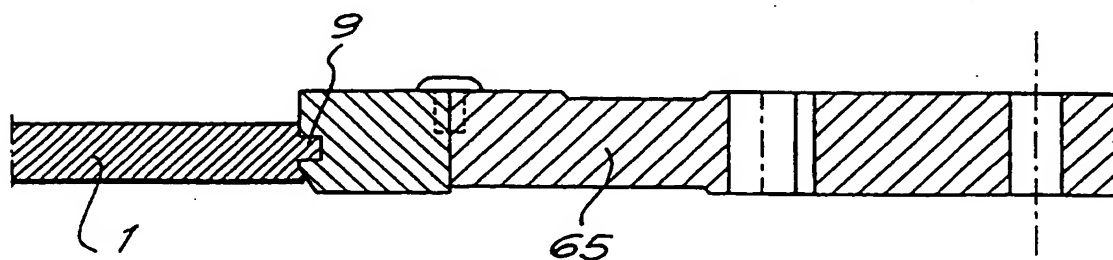
6/10



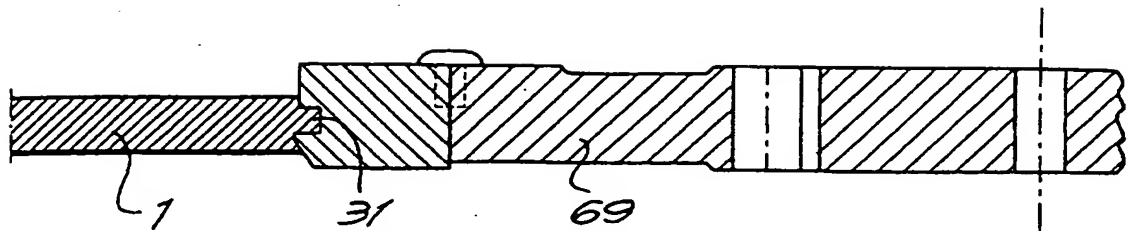
*Fig. 14*



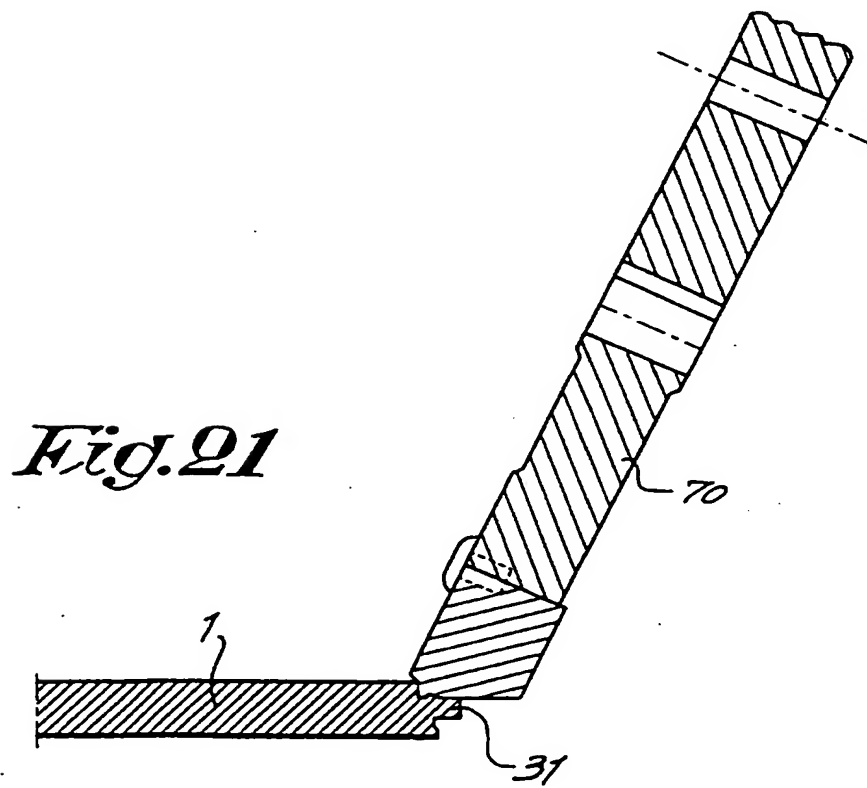
*Fig. 15*



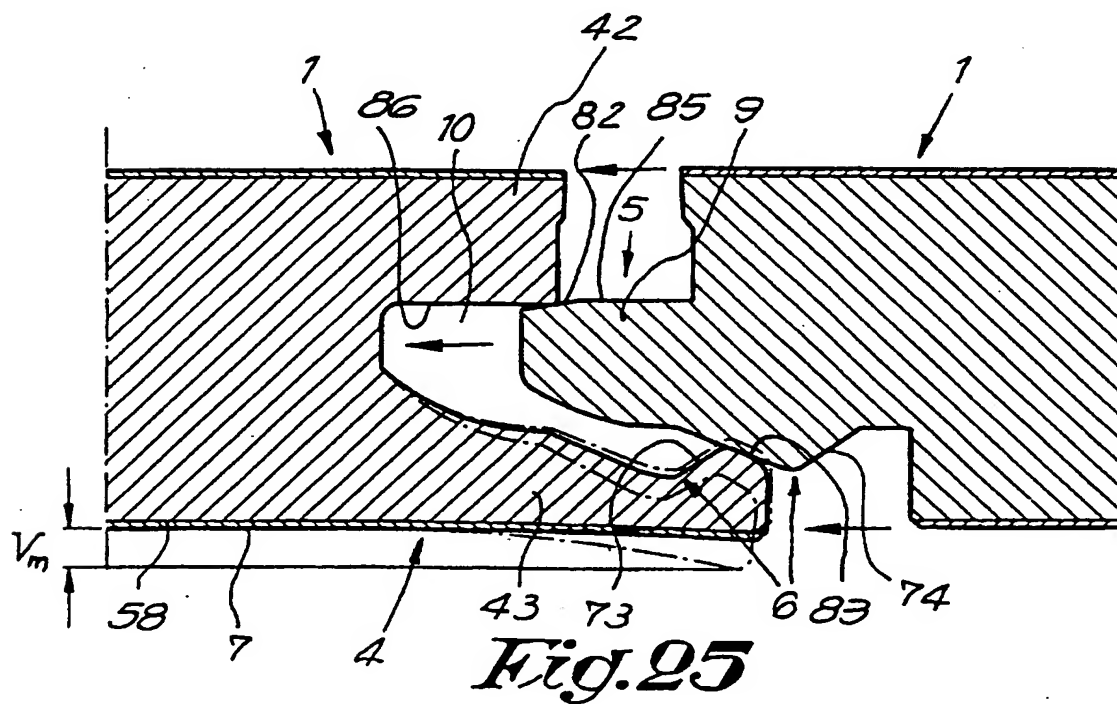
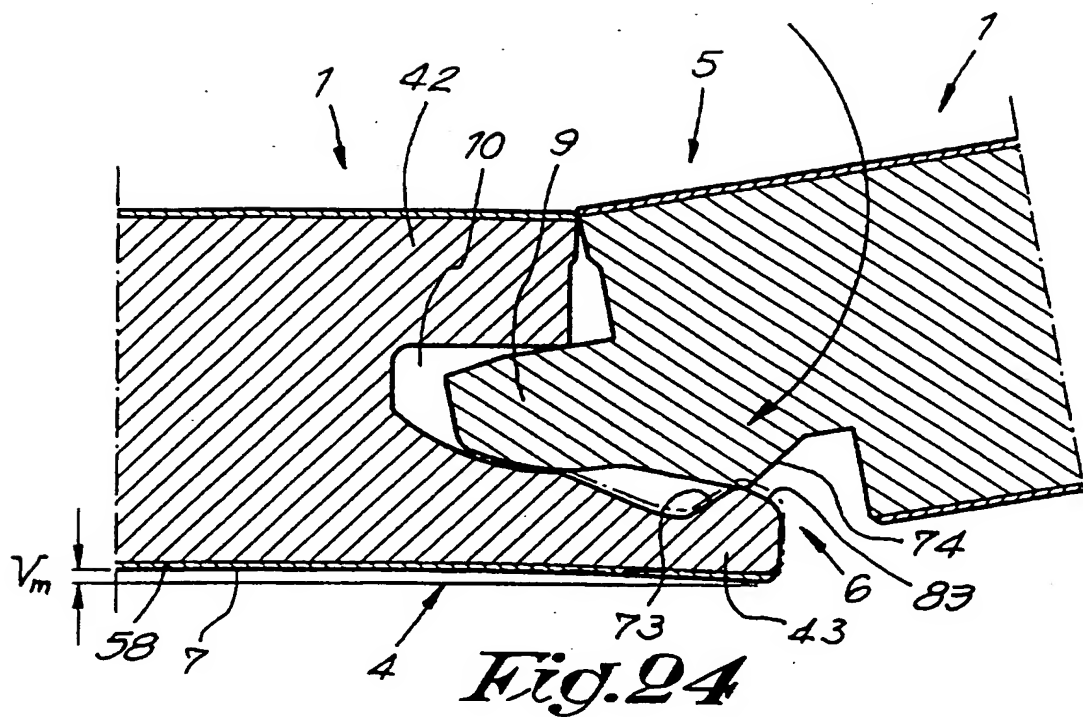
*Fig. 16*



*Fig. 20*



*Fig. 21*





# INTERNATIONAL SEARCH REPORT

Intern. al Application No  
PCT/EP 97/03006

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 35 44 845 A (LIEBICH) 19 June 1987 cited in the application see column 7, line 47 - column 13, line 10; figures 1-5 ---	1,7,9, 10,24-26
A	GB 424 057 A (SMITH) 14 March 1935 cited in the application  see the whole document ---	1,4,7,9, 10, 23-26,28
A	GB 2 117 813 A (OSTROVSKY) 19 October 1983 cited in the application see page 2, line 41 - page 3, line 81; figures 1,2 -----	1,9,11